

MWI 8040.6

REVISION A

EFFECTIVE DATE: February 2, 2002

EXPIRATION DATE: February 2, 2007

MARSHALL WORK INSTRUCTION

ED01

FUNCTIONAL AND PHYSICAL CONFIGURATION AUDITS, MSFC PROGRAMS/PROJECTS

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DOCUMENT HISTORY LOG

| Status (Baseline/ Revision/ Canceled) | Document Revision | Effective Date | Description |
|--|----------------------|-------------------|--|
| Baseline | | 4/5/01 | Document prepared to comply with RCAR 156 to define requirements and responsibilities for performing Functional and Physical Configuration Audits. |
| Revision | A | 2/2/02 | 6.2.8.2, 2 nd sentence, revised to read: "Assist the project in reconciling differences between the as-designed and as-built manufacturing documentation....." 6.2.9 - Added: "Note: To assist the PM/SE in assigning and compiling the actions/actionees required for closeout, the format in Figure 1 was developed." Added Figure 1 - new format for FCA/PCA Action Items. Appendix, paragraph 5, third sentence added: "To assist the Systems Engineer and the Program Manager in assigning and compiling the actions and actionees for closeout, the format of Figure 1 should be utilized." Appendix, paragraph 5.2.3, 1 st sentence, revised to read: "Safety and Mission Assurance will generate the as-built electronic data file and documentation from the inspection records and review manufacturing documentation...." [Footer URL updated 01/14/2004 by Directives Manager.] |
| | | | |
| | | | |

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1. PURPOSE

This Marshall Work Instruction (MWI) provides instructions for conducting a Functional Configuration Audit (FCA) and/or Physical Configuration Audit (PCA). It includes guidance for the preparation of an audit review plan tailored to the needs of the specific project.

NOTE: FCA/PCA objectives may be combined with other reviews, per project discretion. However, these reviews shall be identified and documented in each project plan and shall include the FCA/PCA objectives as defined by this MWI. Further, the project manager (PM) shall ensure the data requirements necessary to conduct the review and FCA/PCA are identified and provided.

2. APPLICABILITY

This Instruction applies to all MSFC programs/projects that conduct an FCA/PCA.

3. APPLICABLE DOCUMENTS

3.1 MPG 1440.2, "MSFC Records Management Program"

3.2 MPG 8040.1, "Configuration Management, MSFC Programs/Projects"

3.3 MPG 8060.1, "Flight Systems Design/Development Control"

3.4 MWI 7120.4, "Documentation Preparation, MSFC Programs/Projects"

3.5 MWI 1280.5, "MSFC ALERT Processing"

4. REFERENCES

QS10-QA-008, "Summarizing As-Built Configuration"

5. DEFINITIONS

5.1 As-Built Configuration. Defines the actual hardware condition as a result of inspections performed and documented on the parts tags during the manufacturing and assembly process. For in-house projects, the as-built configuration is provided as an end-item summary under QS10-QA-008, "Summarizing As-Built Configuration."

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5.2 As-Designed Configuration. Consists of the original design drawings, parts lists, and changes thereto used to initiate the manufacture and assembly process. It is usually summarized by the end item or configuration item. For in-house projects, this summary is developed through the Integrated Configuration Management System, as defined in MPG 8040.1.

5.3 Functional Configuration Audit (FCA). The formal examination of functional characteristics of a configuration item, prior to acceptance, to verify that the item has achieved the performance specified in the functional and developmental baseline identification documentation.

5.4 Physical Configuration Audit (PCA). The formal examination of the as-built configuration item against its as-designed documentation.

6. INSTRUCTIONS

6.1 General. Audits are normally conducted by a team consisting of the PM or designee, System Engineer (SE) as overall technical coordinator, and representatives from Configuration Management (CM), Safety and Mission Assurance (S&MA), and the responsible design and manufacturing organizations. If required, separate teams for specific functions may be established. The Organization of Primary Responsibility Designee (OPRD) is normally responsible for providing the required audit documentation. Whenever possible, the teams should be made up of an independent set of reviewers.

6.2 Specific steps for either a concurrent FCA/PCA or a separate FCA and PCA are as follows:

| | <u>Actionee</u> | <u>Action</u> |
|-------|-----------------|--|
| 6.2.1 | PM | Directs the FCA/PCA be performed prior to shipment of the deliverable product. Precoordinate schedule with S&MA, CM, and design organizations. |
| 6.2.2 | PM/SE | Identify team members and their responsibilities for the audit. |
| 6.2.3 | PM/SE | Prepare the FCA/PCA plan using the attached Appendix as a guide and format in accordance |

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with MWI 7120.4. Distribute
for review.

6.2.4 Team Members

Review plan and provide
comments/concurrence.

6.2.5 PM/SE

Incorporate comments,
approve the final plan, and
distribute the plan to all
organizations involved with
the audit.

6.2.6 OPRDs

Provide required
data/documents/drawings to
project. See Table 1 for a
representative listing.
NOTE: The data shall be
made available 1 to 2 weeks
prior to the audit.

6.2.6.1 S&MA

Provides the as-built
configuration definition
(electronic data file) to
the project and CM.

6.2.6.2 CM

Provides the as-designed
configuration definition
from the MSFC Release
System records. Performs
the as-designed/as-built
comparison and provides a
discrepancy report to the
project.

6.2.7 PM/SE

Assemble audit package(s)
and make available to team
members.

6.2.8 Team

Conducts audit review.

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6.2.8.1 Responsible Design
Organizations (RDOs)

(Areas of emphasis:
Requirements,
Traceability,
Test/Analysis Results,
and Verification)

Chair Engineering Team, if
applicable. Document
findings and actions and
provide to the PM/SE.

a. The FCA typically
consists of reviewing the
hardware design and
performance as dictated by
requirements specified in
the End-Item Specification
and its flow-down
requirements. Other areas
of emphasis include
ensuring that requirements
and design documentation
are complete and approved
(all changes incorporated),
reviewing test reports,
analyses, verification
compliance, comparing
qualification and flight
unit configurations, and
ensuring qualification test
variances are approved.

b. The PCA typically
consists of confirming the
as-designed and as-built
configuration, assisting
the project in reconciling
differences between the as-
designed and as-built
configuration, reviewing
test reports, log books (if
used), deviations and
waivers, nonstandard parts,
drawings, and Materials
Identification Usage
List/Material Usage
Agreement (MIUL/MUA).

6.2.8.2 S&MA

(Areas of emphasis:
As-Built Configuration,

Chair S&MA Team, if
applicable. Document
findings and actions and
provide to the PM/SE.

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Manufacturing Planning and Inspection Records System, Nonconformance Documentation, Review of Test Documentation, Vendor ADPs, and Safety-Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL)-ALERTS)

Assist the project in reconciling differences between the as-designed and as-built configuration, review manufacturing documentation (build paper) for completeness, review inspection records, ensure stamps are legible, verify traceability data (serial/lot numbers, etc.), review deviations and waivers and ensure the incorporation of engineering changes, review nonconformance/Material Review Board (MRB) documentation, review test procedures to ensure appropriate S&MA buy-off, review vendor acceptance data packages, ensure hazard reports and FMEA/CILs are complete, and ensure that all applicable ALERTS, per MWI 1280.5, have been reviewed. NOTE: In-house projects will define in their audit plans what the required support of the manufacturer's quality assurance personnel and associated records will be for the S&MA (QA) Team.

6.2.8.3 CM

(Areas of emphasis: CM Plans and Processes, Completion of Reviews/Audits actions, Configuration Identification, Documentation and Drawing system review, Change Management, Configuration Status

Chair CM Team, if applicable. Document findings and actions and provide to the PM/SE. Assist the project in reconciling differences between the as-designed and as-built configuration, ensure that requirements and design documentation are approved and released (all changes incorporated),

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Accounting and Verification)

verify that all previous design review actions are closed, review changes and configuration accounting, and ensure any hardware unavailable for shipment or open work is documented in the FCA/PCA certification.

6.2.9 PM/SE

Consolidate team findings and comments. Assign actions/actionees required for closeout. NOTE: To assist the PM/SE in assigning and compiling the actions/actionees required for closeout, the format in Figure 1 was developed.

6.2.10 PM/SE

Track and approve closeout actions. PM/SE should coordinate closeout actions with the originator of the finding. Provide instructions for the retention of all audit records.

6.2.11 PM

In those few cases that the PM is unable to achieve complete closeout of discrepancies, the PM may request the formal support of Center personnel, through existing organizational channels, to review the findings and provide direction for the closeout. In the event this option is exercised, the audit plan shall document the process to be used.

6.2.12 FCA/PCA Review Group

When identified by the project plan and/or other MSFC official

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correspondence, provide assistance to the FCA/PCA PM in the review and disposition of open items and assign actions as appropriate.

6.2.13 CM

Support review group activities including preparing and distributing review group meeting minutes.

6.2.14 PM or Review Group
Chairperson

Close the audit when all action items are satisfactorily closed.

6.2.15 PM/SE and Team

Sign FCA/PCA completion certification with consolidated findings/actions attached. (Closure may be conditional upon completion of action closures or open work.)

7. NOTES

None

8. SAFETY PRECAUTIONS AND WARNING NOTES

None

9. RECORDS

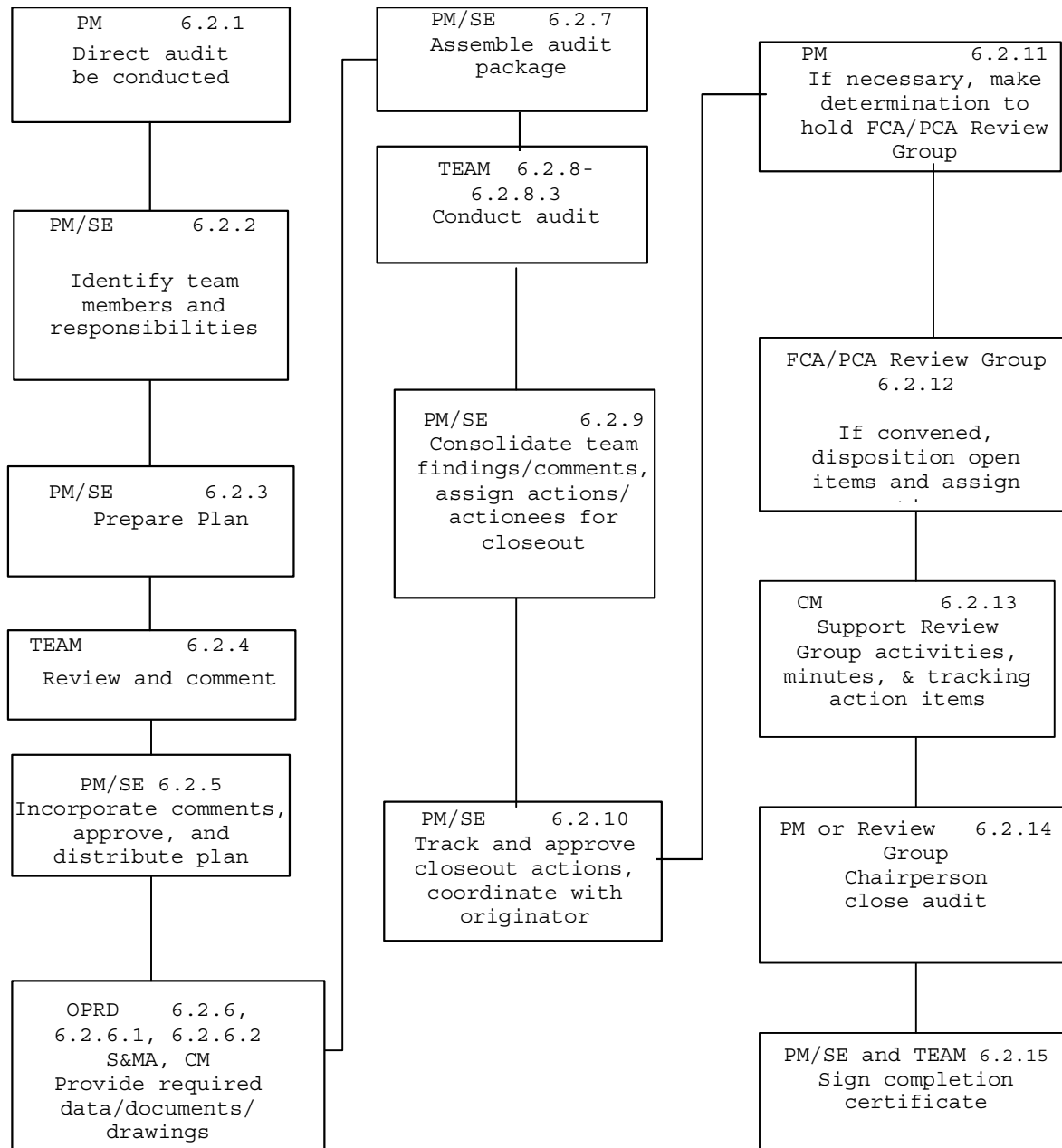
The Audit Plan is a record. Copies of the Audit Plan will be maintained by the project in accordance with MPG 1440.2 and the project-approved records plans.

10. PERSONNEL TRAINING AND CERTIFICATION

None

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11. Flow Diagram



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12. CANCELLATION

MWI 8040.6 dated April 5, 2001

Original Signed by
Axel Roth for

A. G. Stephenson
Director

| | | |
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FIGURE 1

Action Item (FCA/PCA)

| | | |
|---|---|--|
| CI/CSCI Number: | | Date: |
| Nomenclature: | | Page _ of _ |
| Development/Process Center: _____ | | |
| Developer/Subcontractor: | Audit/Review Location: | Tracking Number: |
| Title/Summary: Discrepancy: | | |
| Recommended Solution/Action | | |
| Category <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> High | Audit Type <input type="checkbox"/> FCA <input type="checkbox"/> PCA | |
| Subsystem(s) | Initiator (Name, Phone #): | |
| Auditee Chairperson: | Action Assigned To (Name, Phone #): | |
| Closure Submittal Date ____ / ____ / ____ | MSFC Chairperson: | |
| Closure (Closure information may be attached): | | |
| Closure Approval: _____ Chairperson Signature | | Action Item Closure Date: ____ / ____ / ____ |

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TABLE 1 - REPRESENTATIVE AUDIT DATA LIST

| <u>FCA</u> | <u>PCA</u> |
|---|---|
| <ul style="list-style-type: none"> Specifications Drawings and parts list Engineering Change Proposals/ Engineering Change Requests (ECPs/ ECRs), & Deviation/Waiver Approval Requests (DARs) incorporated and pending Specification and drawing tree Fracture control plan Structural dynamics, analyses, loads, and models documentation (updated) Materials Usage Agreements (MUAs) Material Identification Usage List (MIUL) Certificate of Qualification(s) (COQs) Verification procedures and requirements Complete list of successfully accomplished tests and test results Complete list of successful tests if detailed test data are not recorded Complete list of tests required but not performed Software verification data Software development documents Software version description Critical Design Review (CDR) completion documentation; Review Item Discrepancies (RIDs) and dispositions report Mission constraints Nonconformance reports Interface control drawings/documents (ICDs) Test plans and procedures Test reports Verification closures | <ul style="list-style-type: none"> Final version of all specifications Product drawings and parts list Configuration accounting and status reports Final version of all software documents Final version of software description document Copy of all FCA findings for each Configuration Item (CI) List of approved and outstanding ECPs and DARs Copies of ECPs and DARs as requested at the audit Indentured parts list/as-designed configuration definition As run test procedures (when applicable, include any test discrepancy records) Drawing and specification tree Copy of parts tags or verification closure for verification items verified by inspection method Manufacturing & inspection (build) records Inspection records or inspection verification closures As-built electronic data Discrepancy Reports (DRs) Log Books |

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| | |
|-----------------------------------|------------|
| • Verification tracking log | |
| <u>FCA</u> | <u>PCA</u> |
| • Analysis reports | |
| • ALERTS tracking log | |
| • Hazard analysis/risk assessment | |

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APPENDIX
EXAMPLE OF FCA/PCA PLAN

MSFC-PLAN-TBD
DATE:

MSFC PROJECT DOCUMENTATION

[Insert Organization and Office Symbol]

FUNCTIONAL CONFIGURATION AUDIT/PHYSICAL CONFIGURATION AUDIT PLAN
FOR
[Insert Program/Project Name]

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**FUNCTIONAL CONFIGURATION AUDIT/
PHYSICAL CONFIGURATION AUDIT PLAN**

[INSERT PROJECT NAME]

PREPARED BY

Name/Organization

APPROVED BY

Name/Organization
System Engineer
Title of Organization

Name/Organization
Project Manager
Title of Organization

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1. Purpose

[This section describes the overall planning for the conduct of the FCA/PCA, as required by MWI 8040.6. See example below.]

This plan defines the schedule, membership, data/documentation requirements, action/actionee assignments and closeout, and the support necessary for the [project name] FCA/PCA. In the event a delta FCA/PCA is required, this same plan will be used unless otherwise specified.

2. Objectives

[This section describes objectives of the FCA/PCA. See example below.]

The objectives of the FCA/PCA are as follows:

2.1 Verify that the functional performance complies with the end item specification.

2.2 Verify that the as-built and the as-designed configurations are the same. If there are differences, provide reconciliation rationale for those differences.

2.3 Provide documented rationale for closeout of discrepancies uncovered by the audit.

3. Schedule

[This section identifies the relevant milestones for this FCA/PCA. See example below.]

| | |
|-----|-----------------------------|
| TBD | FCA/PCA Plan Available |
| TBD | Data Package Available |
| TBD | FCA/PCA Kickoff |
| TBD | Conduct FCA/PCA |
| TBD | Action/Actionee Resolutions |
| TBD | Review Group (If required) |

4. Hardware

[This section identifies the hardware/software elements that will be audited for this FCA/PCA. See example below.]

The FCA/PCA will be conducted for the following assemblies:

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- *[Name of Configuration Items (CIs)/Computer Software Configuration Items (CSCIs)]*
- *[Name of Assemblies]*
- *[Other Items to be Audited]*

5. Review Process

[This section describes the process to be used for the FCA/PCA. See example below.]

The FCA/PCA review data package will be located in a reserved room, close to the manufacturing and quality data, for the team members to conduct the audit. The FCA/PCA review process will start with a kick-off meeting to familiarize the reviewers with the items to be audited and to review logistics. To assist the SE and the PM in assigning and compiling the actions and actionees for closeout, the format of Figure 1 should be utilized. The audit will proceed with reviewers assigned to the teams as identified in section 5.2. The responsible design organizations' team members will focus on design and performance. The S&MA team will review inspection records and as-built and test documentation in conjunction with the hardware. The configuration management team members will review and compare the as-designed and the as-built data.

The team members will report their findings to the SE. The SE and PM will review the discrepancies and will assign the appropriate project personnel or contractors to resolve the issues as required. The project will log all discrepancies or findings on a Discrepancy Tracking Log (see example on Table 5.0). The project will provide status reporting and tracking against the log.

At the conclusion of the review, if required, a review group will be convened to address the discrepancies and/or findings that could not be closed during the audit. The FCA/PCA review group members are identified in section 5.3.

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Table 5.0 Discrepancies Tracking Log

Each issue will be assigned a sequential number.

| Issue Number | Description of Issue | PM/SE Assignment of Action/ Actionee | Due Date | Review Group Disposition If Required | Status |
|-----------------|-------------------------|---|-------------|---|--------|
| | | | | | |
| | | | | | |
| | | | | | |
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| | | | | | |
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5.1 Review Data Package

[This section describes the materials and data to be reviewed applicable to FCA/PCA. See Table 1 of MWI 8040.6 for a representative listing of audit data. See example below.]

The data package contents and responsibility for preparation (Organization of Primary Responsibility Designee (OPRD) are identified in Table 5.1-1.) Documentation such as manufacturing instructions, work orders, and parts tags, which may not normally be copied, may be made available as required. These shall be specified in the NOTES section of the table. The documents listed in Table 5.1-2 are for reference. These documents define the program requirements and/or provide information of value to the FCA/PCA participants but are not subject to review.

Table 5.1-1 Data Package Contents Audit Documents

| Document Number | Title | OPRD | Due Date | Notes |
|--------------------|-------|------|-------------|-------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

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Table 5.1-2 Data Package Contents Reference Documents

| Document Number | Title | OPRD | Due Date | Notes |
|-----------------|-------|------|----------|-------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

5.2 Team Organization

[This section describes team organization and membership. See examples below. Tailoring of the specific team responsibilities for each project will be required.]

5.2.1 The SE is the overall coordinator for the schedules, logistics, and related issues, including records retention.

5.2.2 The RDO will review hardware design and performance as dictated by requirements specified in the End Item Specification and its flow-down requirements. Other areas of emphasis include deviations and waivers, nonstandard parts, and drawings.

RDO Team:

| Area of Responsibility: | Name/Office Symbol: |
|-------------------------------|---------------------|
| | |
| Team Lead | TBD |
| Stress | TBD |
| Mechanical Design | TBD |
| Structural Test | TBD |
| Thermal | TBD |
| Materials | TBD |
| Program Office Representative | TBD |
| KSC Representative | TBD |
| Contractor Representative | TBD |

5.2.3 Safety and Mission Assurance will generate the as-built electronic data file and documentation from the inspection records and review manufacturing documentation (build paper) for completeness of inspection records, tags, and acceptance data package. In-house projects shall identify the required support

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and records required from the manufacturer's quality assurance personnel.

S&MA Team:

| Area of Responsibility: | Name/Office Symbol: |
|------------------------------|---------------------|
| | |
| S&MA (Team Lead) | TBD |
| Manufacturing | TBD |
| Quality Assurance Contractor | TBD |
| Manufacturing Contractor | TBD |

5.2.4 Configuration Management will perform the as-designed/as-built physical comparison and review changes and configuration accounting.

CM Team:

| Area of Responsibility: | Name/Office Symbol: |
|--|---------------------|
| | |
| Project Configuration Management (Team Lead) | TBD |
| Data Management | TBD |
| Configuration Management | TBD |

5.3 FCA/PCA Review Group

The FCA/PCA Review Group will address all open issues/open work and will assign action(s) as necessary. Upon completion of the FCA/PCA Review Group meeting, the FCA/PCA Certificate of Completion will be issued contingent upon completion of the open actions/open work. The Review Group members are identified below:

| | |
|-------------------------------|-----------------------------|
| Chairperson | TBD (Dir. or Dept. Manager) |
| ED Representative | TBD (Department Manager) |
| S&MA Representative | TBD (Department Manager) |
| Customer Representative | TBD (Program Office Rep.) |
| KSC Representative | TBD |
| Others as Required by Project | |

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[Project Name]
FCA/PCA
Certificate of Completion

[Chairperson]

Date

[Review Group Member]

Date

[Review Group Member]

Date

[Review Group Member]

Date

The Review Group hereby certifies that the subject audit is complete contingent upon closure of the following open actions/open work:

[Reference the list of open actions/open work if necessary.]